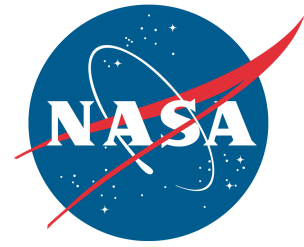


# NASA Mission Summary

National Aeronautics and  
Space Administration

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## STS-125 MISSION SUMMARY

May 2009

### SPACE SHUTTLE ATLANTIS (STS-125)

Space shuttle Atlantis' 11-day mission is the final shuttle flight to NASA's Hubble Space Telescope. The seven-member crew will enhance the observatory and ensure cutting-edge science. The mission puts in place advanced technology that improves the telescope's discovery power by 10 to 70 times. Five spacewalks are planned to install new instruments and thermal blankets, repair two existing instruments, refurbish subsystems and replace gyroscopes, batteries and a unit that stores and transmits science data to Earth. The result will be six working, complementary science instruments with new capabilities, and an extended operational lifespan through at least 2014.

### CREW

	<b>Scott Altman</b> Commander (Retired Capt., U.S. Navy) <ul style="list-style-type: none"> <li>• Veteran of three spaceflights</li> <li>• Age: 50, Hometown: Pekin, Ill.</li> <li>• Married with three children</li> <li>• Commanded previous Hubble servicing mission</li> <li>• Completed three deployments flying the F-14</li> </ul>		<b>Gregory C. Johnson</b> Pilot (Retired Capt., U.S. Navy) <ul style="list-style-type: none"> <li>• First spaceflight</li> <li>• Age: 55, Born: Seattle</li> <li>• Married with five children</li> <li>• Logged 9000+ hours in 50 different aircraft</li> <li>• Completed three deployments flying the A-6E</li> </ul>
	<b>Michael Good</b> Mission Specialist-1 (Col., U.S. Air Force) <ul style="list-style-type: none"> <li>• First spaceflight</li> <li>• Age: 47, Hometown: Broadview Heights, Ohio</li> <li>• Married with three children</li> <li>• Logged 2100+ hours in 30 different aircraft</li> <li>• Enjoys running, golf and family activities</li> </ul>		<b>Megan McArthur</b> Mission Specialist-2 <ul style="list-style-type: none"> <li>• First spaceflight</li> <li>• Age: 38, Home state: California</li> <li>• Ph.D. Oceanography, UC-San Diego, 2002</li> <li>• Served as a capsule communicator</li> <li>• Enjoys scuba diving, backpacking and cooking</li> </ul>
	<b>John Grunsfeld</b> Mission Specialist-3 <ul style="list-style-type: none"> <li>• Veteran of four spaceflights</li> <li>• Age: 51, Born: Chicago; married, two children</li> <li>• Ph.D., physics, University of Chicago, 1988</li> <li>• Making his third flight to Hubble</li> <li>• Five previous spacewalks on Hubble</li> </ul>		<b>Mike Massimino</b> (mass-a-MEE-no) Mission Specialist-4 <ul style="list-style-type: none"> <li>• One spaceflight, STS-109 to Hubble</li> <li>• Married with two children</li> <li>• Age: 47, Hometown: Franklin Square, N.Y.</li> <li>• Two previous spacewalks on Hubble</li> <li>• Ph.D., mechanical engineering, MIT, 1992</li> </ul>
	<b>Andrew Feustel (FOYS-tuhl)</b> Mission Specialist-5 <ul style="list-style-type: none"> <li>• First spaceflight</li> <li>• Age: 44, Hometown: Lake Orion, Mich.</li> <li>• Married; enjoys auto restoration and guitar</li> <li>• Ph.D. geological sciences, 1995</li> <li>• Designed land, marine and seismic programs</li> </ul>		<b>Hubble Space Telescope</b> <ul style="list-style-type: none"> <li>• Launched to space on STS-31 in April 1990</li> <li>• Made its 100,000th orbit on Aug. 11, 2008</li> <li>• 43.5 feet long; maximum diameter of 14 feet</li> <li>• Weighs: 26,056 lbs; after STS-125: 26,905 lbs</li> <li>• Orbits 350 miles above Earth</li> <li>• Generates enough data to fill 18 DVDs a week</li> </ul>

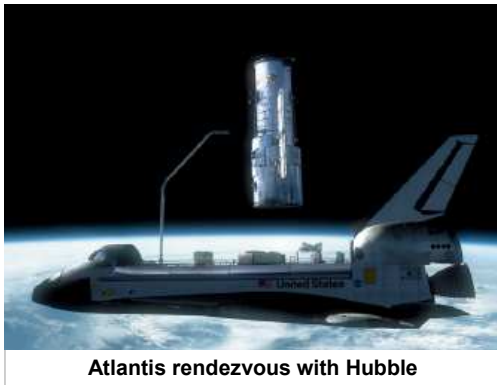


This STS-125 crew patch shows Hubble. The overall structure and composition of the universe is shown in blue and filled with planets, stars and galaxies. The black background is indicative of the mysteries of dark-energy and dark-matter. The red border of the patch represents the red-shifted glow of the early universe. Soaring by the telescope is the shuttle that initially deployed Hubble and has enabled astronauts to continually upgrade the telescope, significantly contributing to the expansion of human knowledge.

**SPACEWALKS** Each will last approximately 6.5 to 7 hours.

(Grunsfeld is Extravehicular -1 wearing the spacesuit with solid red stripes; Feustel is EV-2 wearing the suit with no markings; Massimino is EV-3 wearing broken horizontal stripes; Good is EV-4 wearing barber pole red stripes.)

- On flight day (FD) 4, Grunsfeld and Feustel will replace a wide field camera. Then they will replace a failed science data processing computer that delayed the launch from last October and install a mechanism for a spacecraft to capture Hubble for de-orbit at the end of its life.
- On FD 5, Massimino and Good will change out three boxes, each containing two of the telescope's six gyroscopes, and three batteries.
- On FD 6, Grunsfeld and Feustel will install the Cosmic Origins Spectrograph, a device that will perform spectroscopy, the science of breaking up light into its individual components. The new science instrument replaces COSTAR, the corrective optics package first installed on the first Hubble servicing mission, that enabled the scientific instruments to compensate for the telescope's misshapen primary mirror. The astronauts also will conduct repairs to the Advanced Camera for Surveys, which has experienced power failures, causing two of the telescope's three observing channels to stop operating.
- On FD 7, Massimino and Good will repair and upgrade the Space Telescope Imaging Spectrograph, which stopped working in 2004 due to power failures, and install a stainless steel blanket on Hubble's exterior. The blankets provide additional thermal protection for some equipment bays, replacing the existing multi-layer insulation that has degraded over time.
- On FD 8, Grunsfeld and Feustel will replace the final set of batteries for the telescope, replace a sensor needed for precisely pointing the telescope to gaze at its celestial targets and install another blanket on its exterior.



Atlantis rendezvous with Hubble



Hubble after its last mission



Hubble images

## **FACTS & FIGURES**

- STS-125 is the 126th space shuttle flight, the 30th flight for Atlantis and the second flight in 2009. STS-125 is referred to as Servicing Mission 4 (SM-4), although it is technically the fifth servicing flight to the telescope.
- Among Hubble's greatest discoveries: determining the age of the universe (13.7 billion years); finding that virtually all major galaxies have black holes at their center; discovering that the process of planetary formation is relatively common; detecting first ever organic molecule in the atmosphere of a planet orbiting another star; and providing evidence that the speed at which the universe is expanding is accelerating--caused by an unknown force that makes up more than 75 percent of the universe.
- The farthest objects Hubble has seen are galaxies more than 12 billion light years away.
  - Each Hubble orbit takes 96 minutes. Its speed is about 5 miles per second.
  - Pointing Hubble and locking onto distant celestial objects is equivalent to holding a laser light steady on a dime that is 200 miles away.
- Shuttle Endeavour is being prepared as a backup vehicle for shuttle Atlantis. Endeavour will be designated STS-400 if in the unlikely event that it's needed for a rescue flight.
  - Endeavour will remain on Launch Pad 39B while Atlantis is in space. Once the shuttle is cleared to return to Earth, Endeavour will move to Pad 39A for its next flight, STS-127 to the space station.
- Hubble was deployed on April 25, 1990. In June 1990, Hubble's misshapen primary mirror was discovered.
  - SM-1, STS-61, launched in December 1993, new instruments were installed and the optics of the flaw in Hubble's primary mirror was corrected.
  - SM-2, STS-82, launched Feb. 11, 1997, greatly improved Hubble's productivity. The installation of new instruments allowed NASA to probe the most distant reaches of the universe.
  - SM-3A, STS-103, launched Dec. 1999, brought Hubble back to life after the fourth of six gyros failed and Hubble temporarily closed its eyes on the universe.
  - SM-3B, STS-109, launched March 2002, installed a new science instrument: the Advanced Camera for Surveys (ACS), creating ten times more discovery power.